TABLE 2.—*Vapor pressure at pyrheliometric stations on days when solar radiation intensities were measured.*

Washington, D. C.			Madison, Wis.			Lincoln, Nebr.			Santa Fe, N. Mex.		
Date.	8 a. m.	8 p. m.	Date.	8 a. m.	8 p. m.	Date.	8 a. m.	8 p. m.	Date.	8 a. m.	8 p. m.
1916.	*Mm.*	*Mm.*	1916.	*Mm.*	*Mm.*	1916.	*Mm.*	*Mm.*	1916.	*Mm.*	*Mm.*
May 1	7.29	7.87	May 5	6.27	7.57	May 1	4.17	4.57	May 4	3.15	2.39
6	9.47	8.18	7	6.27	12.24	3	4.93	4.57	12	3.99	2.16
9	5.36	6.50	11	4.57	4.17	4	5.36	6.50	13	3.15	1.88
10	7.04	12.21	18	4.37	4.57	5	6.76	7.57	15	1.96	1.12
12	4.57	7.57	31	5.56	9.83	6	9.47	8.18	16	1.78	1.52
17	5.36	4.37				7	10.97	12.24	18	3.45	2.87
18	6.50	5.36				8	6.02	5.16	19	3.00	1.96
19	4.75	6.50				10	4.95	2.49	22	2.87	3.63
20	7.04	7.87				17	6.02	5.56	24	4.57	11.81
21	4.95	5.56				22	9.14	12.24	25	4.17	8.81
25	13.13	13.13				23	8.81	13.61	26	3.81	3.63
26	9.47	10.59				24	14.10	16.79	27	2.87	4.17
28	16.20	16.20				25	10.97	19.89	29	3.30	3.00
						28	10.59	10.21			
						30	10.59	10.97			

On the mornings of May 24, 25, and 29 the readings obtained at Santa Fe indicate quite steady atmospheric conditions throughout the half-day periods. Reduced to mean solar distance of the earth and extrapolated to zero air mass they give solar radiation intensities of 1.76, 1.79, and 1.77, respectively. Employing the vapor pressures given by Table 2 in applying to the above measurements the Smithsonian "Abridged procedure for determining approximately the value of the solar constant",[1] we obtain 1.89, 1.91, and 1.88, respectively, or values but slightly lower than Abbot's mean value for the solar constant.

Skylight polarization measurements at Washington on six days give a mean of 51 per cent, with a maximum of 58 per cent on May 19.

Table 3 shows that at Washington there was a deficiency in the total radiation received during the month amounting to 3.7 per cent of the normal. At Madison there was an excess amounting to 4.2 per cent. Since the first of the year the deficiency at Washington is 7.9 per cent of the average amount, and at Madison the excess is 0.3 per cent.

TABLE 3.—*Daily totals and departures of solar and sky radiation during May, 1916.*

[Gram-calories per square centimeter of horizontal surface.]

Day of month.	Daily totals.			Departures from normal.		Excess or deficiency since first of month.	
	Washington.	Madison.	Lincoln.	Washington.	Madison.	Washington.	Madison.
1916.	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*
May 1	590	237	739	110	−217	110	−217
2	325	547	353	−157	92	− 47	−125
3	531	360	727	46	− 96	− 1	−221
4	394	550	676	− 94	93	− 95	−128
5	534	658	692	44	200	− 51	72
6	622	249	582	130	−210	79	−138
7	231	669	596	−262	210	−183	72
8	544	704	703	50	244	−133	316
9	600	578	559	105	118	− 28	434
10	495	468	716	− 1	8	− 29	442
11	520	762	294	23	301	− 6	743
12	644	385	88	147	− 76	141	667
13	282	244	85	−216	−217	− 75	450
14	169	133	157	−329	−329	−404	121
15	595	668	535	96	206	−308	327
16	228	261	607	−271	−202	−579	125
17	514	634	639	15	170	−564	295
18	460	690	376	− 39	226	−603	521
19	711	538	179	213	73	−390	594
20	658	394	190	160	− 72	−230	522
Decade departure						−201	80

[1] Annals of the Astrophysical Observatory of the Smithsonian Institution, Washington, 1908, 2:115.

TABLE 3.—*Daily totals and departures of solar and sky radiation during May, 1916*—Continued.

[Gram-calories per square centimeter of horizontal surface.]

Day of month.	Daily totals.			Departures from normal.		Excess or deficiency since first of month.	
	Washington.	Madison.	Lincoln.	Washington.	Madison.	Washington.	Madison.
1916.	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*
May 21	718	162	410	220	−304	− 10	218
22	315	480	676	−183	13	−193	231
23	102	537	678	−396	69	−589	300
24	252	448	609	−245	− 21	−834	279
25	621	419	693	124	− 51	−710	228
26	636	531	626	140	59	−570	287
27	581	458	621	85	− 17	−485	270
28	534	671	570	39	193	−446	463
29	452	242	662	− 42	−239	−488	224
30	267	732	731	−227	249	−715	473
31	637	615	338	144	130	−571	603
Decade departure						−341	81
Excess or deficiency since first of year. gr.-cal.						−4,057	+128
Excess or deficiency since first of year. per cent.						−7.9	+0.3

CIRCUMHORIZONTAL ARC OBSERVED.

By JULIAN T. GRAY, Assistant Observer.

[Dated: Weather Bureau, Cincinnati, Ohio, June 13, 1916.]

On June 5, 1916, while observing a very bright solar halo of the ordinary type, a phenomenon was noticed which at first was believed to be the lower portion of the great halo of 46°. The arc was 30° or more in extent, concave to the sun, and so situated that its middle point appeared vertically beneath the sun. It was also remarkable for its vivid colors, and in this characteristic it bore a strong resemblance to the "circumzenithal arc," an example of which the writer observed at Ludington, Mich., during the winter of 1913–14.

The fact was at once noticed that the arc appeared flat, i. e., not having that degree of curvature which would be expected of a halo of 46°, and it was not concentric with the halo of 22°. So far as we are able to judge, the arc was parallel to the horizon at an altitude of about 20°, with, perhaps, a slight upward curve at either extremity. It therefore seems reasonably evident that we had to do with the "circumhorizontal arc" or "lower tangent arc of the halo of 46°," concerning which Besson says, "So far, only three or four observations of this arc are known."

The phenomenon remained visible for about 15 minutes after discovery—from 12:50 to about 1:05 p. m. (90th Meridian time). During this period the sky was everywhere visibly covered with thin cirrus or cirro-stratus clouds in which numerous white streaks and patches appeared. We endeavored to make such measurements as were possible without instrumental equipment, which, though lacking in that degree of accuracy which would be desirable, are presented with the belief that the possible limits of error in either direction are such that the results obtained may be of some value.

A piece of cardboard in which a pin was stuck perpendicularly at the end of a black line served as a sort of sextant, by means of which our measurements were made. The angles were plotted on the cardboard and measured with a protractor. The measurement was taken in each case from a point as near the middle of the band or ribbon of light as could well be judged.

The radius of the ordinary halo as measured was exactly 22½°, which, considered as a check, may indicate that the other measurements made by the same method are approximately correct. The solar distance of the arc at 1 p. m. was measured at 46½°, while the altitude of the sun at the same hour two days later was 66°. The sun's altitude at the moment considered must have been between 68° and 63°, where, according to the theory of Bravais, the solar distance of this arc should be between 46° and 47°. (See "Different forms of Halos and their Observation," MONTHLY WEATHER REVIEW, July, 1914.)

THE BLUE OF THE SKY AND AVOGADRO'S CONSTANT.[1]

By D. PACINI.

[*Reprinted from* Science Abstracts, Sect. A, Mar. 25, 1916, §286.]

Rayleigh's theory attributes the blue of the sky to molecular dispersion; but we have also to do with dust and with molecular agglomerations (on ions, on uncharged nuclei produced by the action of ultra-violet light on oxygen, or on water vapor) which are larger in size than the dimensions required by Rayleigh's theory, but which vary in size and number. The author has studied observed departures from the inverse fourth-power law, and tabulated the calculated value of n in λ^{-n}. It is mostly numerically smaller than 4, but has been found as large as 7. The observations are reduced to a series of typical curves, less or more in disaccord with the theoretical curve, and the probable causes of these discrepancies are considered. A perfect atmosphere would give data corresponding to about 62×10^{22} molecules per gram-molecule; the author finds his observations lead to a value of 57×10^{22}. Dember found by analogous methods 28, Abbot and Fowle 52, and King 62.3, $\times10^{22}$. On the whole, this is sufficient to show that the blue of the sky is mainly due to molecular dispersion.—*A. D[aniell]*.

PHOTOGRAPHY OF ZODIACAL LIGHT AND COUNTERGLOW.[2]

By A. E. DOUGLASS.

[*Reprinted from* Science Abstracts, Sect. A, Apr. 25, 1916, § 424.]

Successful photographs of these phenomena of very slight contrast, were obtained by careful consideration of the conditions to give even illumination and intensification of photographic contrast. A camera lens of very large relative aperture was used (diameter 1 inch, focal length 2 inches), with exposures varying from 8 to 20 minutes. Equally good results were obtained with orthochromatic and ordinary plates, and it was found best to develop with hydroquinone bromide, kept cool, arranged for prolonged development. Evenness of illumination was got by using a special form of panoramic camera, with a focal diaphragm 17 mm. wide, the lens rotating at the rate of 2° per minute. The instrument was provided with three exactly similar lenses rotated by the same clock, so that three negatives were produced for each exposure. For producing positives, these negatives were put together and the copy taken through the combined pictures, thus increasing the contrast values given by a single film.

In the discussion of the paper the question was raised whether it might not be better to make a series of positives from each negative and superpose these for the increase of contrast instead of the negatives; also the importance in such work of attending to the perfect cleanliness of the lens surfaces, elimination of lens or camera glare, danger of diffraction with small apertures, etc.—*C. P. B[utler]*.

PROPAGATION OF SOUND IN THE ATMOSPHERE.[3]

By E. VAN EVERDINGEN.

[*Reprinted from* Science Abstracts, Sect. A, Apr. 25, 1916, § 458.]

In various investigations on the propagation over great distances of sounds from intense sources, specially in the case of volcanic eruptions and explosions, deviations have been found, partly regular, partly irregular. The source of sound is always surrounded by an area of regular or irregular shape, where the sound is heard everywhere, but the source is far from being always situated symmetrically within this area, and the dimensions of the latter are not even in the first place determined by the intensity of the sound. In many cases a second area of audibility occurs, separated from the first by a region where no sound at all is heard. Sometimes this second area partly surrounds the first; sometimes it consists only of isolated spots. It can be said generally that the smallest distance from the source of sound for this second area is usually much more than 100 kilometers and that the intensity of sound at this smallest distance is no less than at the outer border of the first area of audibility, which is much nearer to the source of sound. These facts are illustrated by diagrams of seven different cases which have previously been investigated. These are as follows: (1) Explosion of 15,000 kilograms of dynamite at Farde, in Westphalen, December 14, 1903 [G. von der Borne, Abs. 106 (1911)]; (2) explosion of 25,000 kilograms of dynamite near the Jungfrau Railway November 15, 1908 (A. de Quervain); (3) three eruptions of the volcano Asama in Japan on December 7, 1900, December 25, 1910, and April 4, 1911 (F. Fujiwhara); (4) explosion of gunpowder and dynamite at Kobe April 3, 1910 (S. Fujiwhara); (5) explosion of 200,000 kilograms of gunpowder in a magazine at Wiener-Neustadt on June 7, 1912 [J. N. Dörr, Abs. 1295 (1914)].

Two chief lines have been followed in the endeavor to explain these facts. The first way, now quite old, ascribes the abnormal propagation of sound to the influence of variations in temperature and wind velocity in the superposed layers of air in the atmosphere. It is easy to see how, by certain suppositions about the vertical distribution of wind velocity, the peculiarities of the propagation of sound, specially the silent region, may be explained. The influence of temperature, which decreases upward, is a decrease of the velocity of sound in the higher regions, thus causing the sound rays to curve upward from the earth. A horizontal wind in the direction of the sound, and with higher velocities at higher levels, may counteract the above temperature effect and overcome it, so turning the rays down again to the earth. A silent region followed by a second audible area is thus accounted for.

The second and entirely different line of thought was put forward by Von der Borne. He supposes that the appearance of silent regions, in some cases at least, may be due to the change in composition of the atmosphere, which is caused by the unequal decrease of the partial pressures of the constituents of the atmosphere. If no mixing by convection currents occurred, each of the gaseous constituents of the atmosphere would form an atmosphere entirely according to its own laws. In consequence

[1] Nuovo cimento, July-Aug., 1915, 10:131-167.
[2] Phot. jour., Feb. 1916, 56:44-47; discussion, 47-48.
[3] Proc., K. Acad. Amsterdam, 1916, 6, 18:933-960.